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Copper adsorption from aqueous solution by activated carbon of wax beans waste activated by magnetite nanoparticles

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ABSTRACT

Copper, a heavy metal, causes environmental pollution through a variety of industrial processes in many countries. Adsorption is known as an effective and efficient way of removing heavy metals. The present study was conducted mainly to magnetize the carbon in wax bean waste with magnetite nanoparticles and use it as adsorbent to remove copper from aqueous solution. Carbon was obtained from wax beans waste and activated with magnetite nanoparticles. The characteristics of obtaining adsorbent were studied and analyzed by FE-SEM, BET, and FT-IR. In this study, the effect of pH, adsorbent dose, contact time and copper concentration on the efficiency of copper removal was investigated per full factorial design by the Design Expert Software. The concentration of copper was measured by atomic absorption spectrophotometer (Varian AA240). For statistical analysis of the experiment's data, ANOVA and P-value were used. Copper initial concentration 100 mg/L, adsorbent dose 1 g/L, pH 7 and contact time 40 min were obtained as optimal conditions for copper removal. Investigation of the isotherms indicated that the experimental data of the process were correlated with Langmuir Model. The maximum capacity of copper adsorption of Langmuir Model was 49.75 mg/g. Findings indicated that at optimal conditions, the amount of copper adsorbed from synthetic wastewater and real wastewater was 99.73% and 63%, respectively. Therefore, this method is capable of removing copper effectively and could be used to remove this metal from industrial wastewaters.

Keywords: Copper; Wax bean; Magnetite nanoparticles; Adsorption; Atomic adsorption

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